

## High Reflectance Silicon Dielectric Mirrors for Infrared Astronomy

Completed Technology Project (2013 - 2014)



## Project Introduction

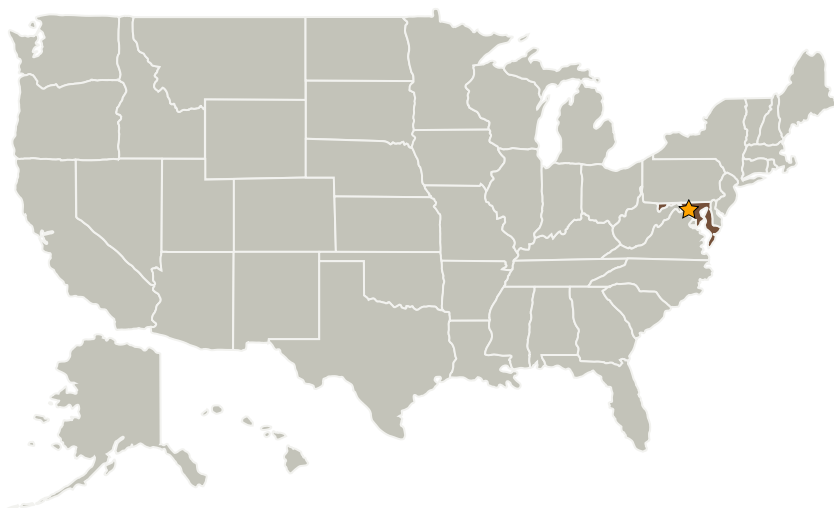
The goal is to mature our fabrication technology to enable broadband, low loss multi-layer dielectric coatings for the mid- to far- IR wavelength range to enhance the performance of optical components operating at cryogenic temperatures.

Conventional high reflectance optical coatings consisting of multilayer stacks of alternating high and low refractive index dielectric materials can achieve high reflectivity and low loss over the visible to the near infra red range. *Unfortunately, conventional all-dielectric interference optical coating technologies are not viable for making these components in the mid to far-infrared range due to large thicknesses required and the lack of materials with low enough absorption at those wavelengths.* The task becomes even harder since the coatings typically have to operate at a cryogenic temperature: multilayered dissimilar materials inevitably crack and delaminate from the substrate surface due to thermal expansion mismatch.

## Anticipated Benefits

The technology has general applicability to high reflectance coatings required for astronomical applications.

## Primary U.S. Work Locations and Key Partners



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## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Goddard Space Flight Center (GSFC)

### Responsible Program:

Center Innovation Fund: GSFC CIF

## Project Management

### Program Director:

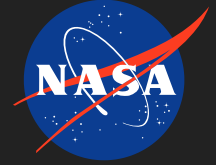
Michael R Lapointe

### Program Manager:

Peter M Hughes

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Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

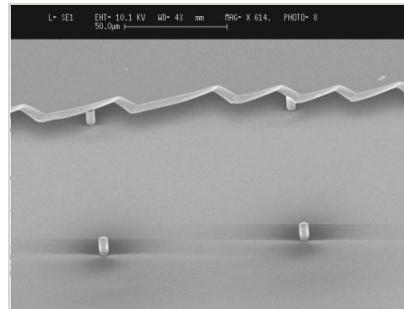
## Primary U.S. Work Locations

Maryland

## Images

## High Reflectance Silicon Dielectric Mirrors

10mm aperture 2layer mirror stack demonstrated in 2013  
(<https://techport.nasa.gov/image/2602>)



## Image of silicon membranes separated by gap defining posts

Scanning electron microscope image showing silicon membranes bonded with low refractive index gap setting silicon bumps. The top 3 micron thick membrane has been broken to display the bumps.  
(<https://techport.nasa.gov/image/2614>)

## Project Website:

<http://sciences.gsfc.nasa.gov/sed/>

## Project Management (cont.)

## Project Manager:

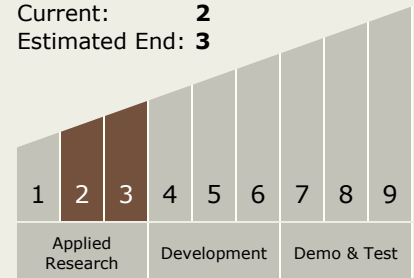
Stanley D Hunter

## Principal Investigator:

Kevin L Denis

## Technology Maturity (TRL)

Start: 2  
Current: 2  
Estimated End: 3



## Technology Areas

## Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes